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ABSTRACT

TIPS (Technologies in Pedagogical Strategies) is a collaborative partnership among the College of Education and Graduate Studies at the University of Wisconsin-River Falls, local school districts, and their respective communities. A key component of the partnership involves meaningful curricular integration of technology, so teachers and students may use this tool to foster higher-level thinking. This study focuses on one segment of the TIPS: teachers' curriculum integration projects. Goals were to document the kinds of technology being used to restructure schools at the classroom level; identify some of the best practices and highlight specific projects that have been designed and implemented by teachers; analyze the growth of respective teachers' experiences with technology integration; and identify challenges teachers face when infusing technology. A preliminary analysis was conducted from interview data with 17 teachers who wrote competitive project grants. Four teachers were selected to study in depth using interviews and observations to analyze how teachers used technology projects to restructure schools at the classroom level. Themes that emerged in all of the interviews included how curriculum, pedagogy, student learning, and assessment changed in the restructured environment, as well as challenges teachers faced with technology infusion. (MES)

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Restructuring At The Classroom Level: Effects With Technology

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Abstract: From interview data with 17 teachers who wrote competitive project grants we conducted a preliminary analysis. From this sample, we selected 4 teachers to study in depth using interviews and observations to analyze how teachers used technology projects to restructure schools at the classroom level. Themes that emerged in all of the interviews included how curriculum, pedagogy, student learning and assessment changed in the restructured environment and challenges teachers faced with technology infusion.

1. Introduction

TIPS (Technologies in Pedagogical Strategies) is a collaborative partnership among the College of Education and Graduate Studies at the University of Wisconsin-River Falls; the Hudson, River Falls, and Prescott School Districts; St. Bridget Elementary School; and their respective communities. The funding for this project comes from the Wisconsin Department of Public Instruction Goals 2000 funds, University of Wisconsin-Extension, AT&T, and University of Wisconsin-System PK-16 Initiative. A key component of the partnership involves meaningful curricular integration of technology, so teachers and students may use this tool to foster higher-level thinking.

Our study focuses on one segment of the TIPS: teachers' curriculum integration projects. Last year, TIPS supported 35 teachers' individual or team projects to implement technology in their classrooms. Our goals in this research were to 1) document the kinds of technology being used to restructure schools at the classroom level; 2) identify some of the best practices and highlight specific projects that have been designed and implemented by teachers; 3) analyze the growth of respective teachers' experiences with technology integration and 4) identify challenges teachers face when infusing technology. A team of two faculty and four graduate students in the Teacher Education Department at the University of Wisconsin-River Falls reviewed 17 competitive project grants from 35 teachers and selected four projects for in-depth study and analysis.

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2. Background

In the first year, twenty-three PK-20 faculty participants met on a monthly basis for specific instruction in using technology. During year two, thirty-six PK-20 faculty participated and a technology consultant worked in the schools with teams of participants and monitored individual teachers. For year three, sixteen PK-12 teachers, working with 18 university interns, provided technology mentoring and training to colleagues in their respective buildings in two school districts. During that year, the project supported 35 teachers' projects to implement technology in their classrooms, and interview and observational data from those teachers' projects form the basis of the research on which our proposal is based. Most recently, during the fourth year, 27 teachers and 27 interns in three school districts and a private school assisted others with the instructional integration of technology and supported 50 projects from over 100 teachers. Many states are providing grants to teachers to encourage technology integration. This research may provide some insight as to how teachers are changing teaching practices by introducing technology, and the effects of this pedagogical change on the learning outcomes of students in these teachers' classrooms.

2.1 How Technology is Being Used in Classrooms

Technology is infused in different ways at different degrees and styles across various content areas and grade levels. Schools have differing internal structures that support this endeavor, and each teacher is confronted with differing challenges. The future of technology in the classroom will depend on continued research and efficient support systems for teachers who are exploring new ways of teaching and of promoting learning. This research attempts to enhance our understanding of this complex process.

Our description of the projects will be summarized in accordance with four categories by which technology is used in the classroom: Instructional software, Instructional support tools/hardware, Telecommunicating/telecomputing/networking, and Multimedia [Forcier, 1996; Jonassen, 1996; Means, 1994; Newby, Stepich, Lehman and Russell, 1996; Roblyer, Edwards and Havriluk, 1997].

2.1.1 Instructional Software

This involves word processing; spreadsheets; simulations; tutorials; drill & practice; desktop publishing; CAD; problem solving games; test generator; instructional games; photo editing; Hyper Studio; and C-maps. Another category of instructional software is used to aid teachers in maintaining records of students' grades and other work. First grade students learn to use Hyper Studio software to construct an electronic portfolio. These portfolios are continued in subsequent grades so that students, teachers and parents have a multimedia record of the elementary education of individual students (see 3.1 Hyper Studio Electronic Portfolio Project). A new zip disk and an existing Alpha Smarts Program allow teachers and 2nd grade students to tackle large writing projects. An interactive laser disc simulation program is used in a middle school science class to promote math and problem solving skills as students figure out what caused an accident and other real life problems.

2.1.2 Instructional Support Tools/ Hardware

This refers to the physical or technological inventory contained in the learning environment. Examples include at the base level: computers; monitors; scanners; CD-ROM's; printers; LCD's; RGB-TV converters; audio speakers; modems; overhead projectors; closed circuit televisions; and calculators. At a more specialized level examples would include: CBL's, GPS's; digital cameras; digital video cameras; and zip drives. A high school calculus teacher has students using Global Positioning Satellite(GPS) Instrumentation to survey a practice field and snow fence. Students use the GPS, a traditional transit, and calculus applications to measure angles and curves and to plot coordinates of latitude and longitude. A high school biology teacher incorporates Calculator Based Laboratories (CBL) to examine how various pH levels affect reactions, to test the effectiveness of different strains of yeast, and to study the effects of various levels of exercise on heart rates.

2.1.3 Telecommunicating/Telecomputing/ Networking

This category comprises software and hardware which facilitates communication via technology utilizing e-mail; bulletin board systems; Internet; teleconferencing and video teleconferencing. These foster the linking of diverse databases, information sources, geographic areas and populations. Second graders are involved with an on-line project called "Journey North" where they track the growth of tulips with other students around the country. A middle school teacher relies on a subscription to the education web site which includes an author chat line to motivate her middle school English students. A 5th grade teacher assigns a famous woman to each of her students. The students use the Internet, Grollier's CD-ROM Encyclopedia, and the school library to do research on their assigned woman. The students fill out forms asking for specific information and present their findings to the class as a poster presentation. A 5th grade teacher has her students use the Internet to research the Civil War and specific topics of interest. Students create projects to show what they had learned, and they present them during an activity day where there is a re-enactment of a Civil War campsite among other activities. A middle school teacher uses e-mail and digital cameras for a project in his science class. The students pick out a variable (i.e. weather, height, etc.) and take a digital picture of the change from month to month. The students send their pictures to key-pals in a neighboring school. The teacher also has the students take a GPS home and send their key-pals the latitude and longitude of their family's homes. A social studies teacher's students select a WWII event; access primary documents such as diaries, newspaper articles, or photographs from the Internet and communicate their projects via participation in a teleconference (see 3.3 WWII Internet Project). A high school English teacher challenges her students to become critically aware of Internet sources. She teaches her students specific skills in examining electronic resources and encourages students to incorporate these and other resources into encompassing projects or term papers in the English classroom. (see 3.4 Evaluating Information Technology Project)

2.1.4 Multimedia

Multimedia is a computer system product that involves the integration of more than one medium into a form of communication by incorporating text, sound, pictures/graphics, and/or video. Digital cameras are used to record classroom activities, and later the information is inserted into Power Point for presentation to parents or other students, submitted to school newsletters or local newspapers, converted to VHS format for "video yearbooks," incorporated into individual classroom projects, or e-mailed to students at other schools. Electronic portfolios, which include representative samples of students' work across the content areas, are shown to the class through a Power Point presentation and later are taken home in VHS format. CBLs, which are connected to graphing calculators, allow students to collect data that is later presented to the class on an overhead projector; students discover information on their own while manipulating numbers on the calculators. A high school biology teacher has her students study organisms indigenous to the Kinnickinnic River basin. The students use digital cameras to make a field guide of the local flora. Through research on the Internet and library resources the students compile a final project on their organisms that are presented in a Power Point format (see 3.2 Kinnickinnic River Biology Project). Video cameras and advanced editing equipment allow students in a high school journalism class to make commercials and create newscasts of extracurricular and classroom activities for the school's broadcast.

3. In-depth Study of Four Projects

Follow-up focused interviews were conducted regarding the projects of one elementary and three secondary teachers (science, social studies and English). After presenting descriptions of each project, we summarize interview information about the changes teachers experienced in curriculum, pedagogy, student learning and assessment, as well as the challenges they faced integrating technology use in the classroom.

3.1 Hyper Studio Electronic Portfolio Project

The elementary teacher is a 1st grade teacher who is engaged in an ongoing five phase electronic portfolio project that is in its first phase. The goals of the project are threefold: 1) to help students become comfortable with computers and technology, 2) to provide students with a technology based project, and 3) to have students create an electronic portfolio that records their academic and extra-curricular achievements throughout their elementary school experience. The students are instructed in the rudiments of Hyper Studio software. The teacher used laminated cards in class to teach the children examples of Hyper Studio screens, keyboard functions and how to use a mouse. Students then worked in pairs to practice the Hyper Studio functions on the computer. After students learned to use the software, they worked independently on their computers to design their electronic portfolio. Students selected items from their hard-copy portfolio as well as current work samples to incorporate into their electronic portfolio. Students designed their electronic portfolio from start to finish.

3.2 Kinnickinnic River Biology Project

With the introduction of block scheduling, the science teacher wrote and implemented a new curriculum for a biology class that involved the Kinnickinnic River which is indigenous to the town of River Falls. The course was designed to allow students to research a macro and microorganism individually on the Internet as well as work collaboratively with other students in the class. Students were encouraged to tie in all the factors related to the ecosystem through food webs and by studying the ecosystem roles and plant life and insect life of the river. Components of this project included: poster presentations; sampling and identifying the actual macro invertebrates of the Kinni River basin; use of the CBL (Calculator Based Laboratories) such as testing the pH, oxygen content and temperature of the river to make conclusions on water quality; designing a food web; capturing images of the flora using a digital camera; and creating a Power Point presentation.

3.3 World War II Internet Project

Using an already existing course called World War II, the social studies teacher infused a technology based project with the goal of sharpening students' intellectual ability. Students were to choose a World War II topic and research it by accessing diaries, photographs, and documents off the Internet and participated in teleconferences. Eventually students were required to also relate Internet resources to print materials, articles, and books about the same event and make comparisons. One goal was that students would be able to critically analyze resources from the Internet. The second goal was for students to use a variety of methods of technology for the final project such as a scanner, quick camera, and camcorder to name a few. The end product differed from student to student ranging from a newspaper, teleconferencing, Power Point presentation and research paper.

3.4 Evaluating Information Technology Project

The English teacher infused technology into the classroom through a project that challenged students to assess and evaluate information technology. The unit required students to pick resources for a specific research topic and then decide if the resources were reliable, valid and appropriate. Topics ranged from Social Security to "beat" poetry of the 1950's and 1960's. Students were instructed to collect sources (text, electronic and human), list the strengths and weaknesses of the sources, rank the sources including a written explanation for the ranking, and develop a criteria the student deemed necessary for determining the appropriateness of sources. The students composed a "Works Cited" page and performed a concluding presentation to the class.

4. Findings

4.1 Curriculum

All four teachers commented that the technology projects required them to rethink what they teach in general while providing them an opportunity to think about what material to include in the curriculum more

specifically. Three important points brought up by three of the teachers included: 1) depth versus breadth, 2) factual content versus process, and 3) change in focus.

Regarding depth versus breadth, the social studies teacher stated that teachers may eventually move away from covering every single part of the curriculum to provide the "big picture" but rather turn to a project based pedagogy in which the project ends up dictating the content of the course. He said, "We let the big picture go and we concentrate on learning the smaller part of the picture well and not worry about covering all of the content."

For factual content versus process, the English teacher stated that in order to incorporate new tools (technology), some instructional time was used to address technology techniques and issues. Therefore, rather than focusing on the English content curriculum, she said she focused more on how students are processing the information.

Similarly, change in focus deals with the idea that teachers are starting to focus on skills they want students to develop in order to become independent learners who can access information on their own instead of focusing only on "what" we want to teach them.

The elementary teacher stated that curriculum and content were not significantly altered. However, she has been using hard-copy portfolios and students are already learning computer skills in their regular computer lab time. She said that this project was a very convenient way to combine those two preexisting activities.

4.2 Pedagogy

All four teachers stated that they have adopted a constructivist style of teaching that is student-centered and project based. They went on to say that they were able to address the variety of learners better in this setting, have moved away from a "teacher knows it all" model and have become much more reflective about their teaching style. The science teacher said,"... you really have to have quality projects planned out there (Kinni River) and they need to be projects that engage the students right away and require them to gather meaningful data, whatever that might be." She went on to state that without her involvement in the Kinni project she would not be questioning herself and her educational philosophy as critically. She said she is constantly trying to refine and develop her pedagogy. The English teacher said that this experience has forced her to rely more heavily on her students who are experts, and therefore she designs units that are more relevant to individual student ability and interest.

4.3 Student Learning

Consistent with the philosophy of a student-centered pedagogy, teachers said that students were taking more responsibility for their own learning, though at times students expressed frustration over the increase in responsibility. Students also developed analytical skills that required them to evaluate material obtained from the Internet for reliability and validity which was often assumed to be present for print material. Students were more focused on the process of learning rather than the end result, though most students were excited and felt very proud of their end products. The teachers stated that the students expressed that it was challenging to adjust to a new way of learning. Student motivation seemed be more intrinsic and student learning generally more positive.

The elementary teacher stated that several of her students who are not academically strong experienced many opportunities for success while engaged in the Hyper Studio electronic portfolio. The following are two examples from the elementary classroom. "One of my poorest readers read her story. She practiced forever and it's wonderful. I laugh every time I hear it." "He couldn't find much academically he wanted to put in but he played the guitar...into his portfolio...this success encouraged him to find other examples of his work which were academic in nature."

4.4 Assessment

The three secondary teachers said that the general structure of how they assess their students' learning did not change but modifications were made based on the nature of the task. For example, the social studies teacher stated that traditional quizzes, discussions, essays and oral presentations were used in general and performance tests were used for teleconferencing or Power Point presentations. Even in the case of performance assessment, he said"...you look at their regular research in the library of print media

and articles and you look at what they got off the Internet and assess their projec:, choices and their questions about the assignment." However, as the project evolved the idea of assessing higher order thinking became the central focus of the assessment.

The science teacher said she also used fairly typical written .ests throughout the term. She administered weekly vocabulary quizzes that dealt with scientific terms and terminology, compilation of daily or regular data sheets twice a week, other daily assignments, projects and labs. She went on to say, that in an applied class like hers, projects like constructing the food web become good assessments of student learning. In order for the students to construct the web properly, students have to master certain concepts about flow of energy in the ecosystem and understand the definitions of the different ecosystem roles. She went on to say more student exchange occurred during this project than during other projects which she thought represented learning and higher order thinking amongst students.

The English teacher also stated that this project did not change her views about assessment in general. However, she felt that her views on assessment have changed gradually over the 24 years as she moved away from using tests to focusing on students' ability to demonstrate expertise.

The elementary teacher said that she did not think this project changed how she thought about assessment. She said at this level and with this type of assessment, watching them do their work through observations and looking for a successful portfolio was her main concern. She also noted that the students who had been academically challenged were producing more and providing better products at times. She did not provide an explanation for the cause of this observation at the time.

4.5 Challenges

There were general challenges and specific challenges related to infusing technology. Some of the general challenges included: making sure everybody stayed busy, not knowing if students were on task, decreasing the human contact with students, struggling with technology that did not cooperate, spending time teaching technology rather than using it for content instruction, overcoming one's own fear and resistance about using technology, and not establishing objective and controlled ways to assess your own practice.

Specifically, the elementary teacher saw the continuation of student portfolios throughout the subsequent grades as a challenge. One of the significant chalienges she saw was how other teachers will become a part of this continuation especially if they lack computer skills. The science teacher noted that complex projects, increased student autonomy and variability of tasks which produced a challenge for objective and efficient methods of grading. The social studies teacher said that one of the main concerns he had was students' lack of necessary background knowledge needed to engage in higher-order thinking, which he envisioned would be the result of this project.

5. Conclusion

The projects implemented by the four teachers have been an avenue by which they were challenged to rethink "what" they teach and "how" they teach. Technology alone can not explain, nor can it become the sole answer for our exploration about changes in curriculum and pedagogy at this present time. Naturally, when a new idea, method or way of doing things is introduced, the tendency is to become more aware of how one does things. Whether novelty of a new method of teaching has caused the changes we observed or technology itself has been the primary cause warrants additional study for us to draw further conclusions. However, teachers' thinking about what they teach and how they teach have been positive outcomes related to these projects nonetheless.

Teachers have moved to a student-centered pedagogy allowing for more ownership and responsibility of student learning. There is still much to learn about how technology infusion changes our way of thinking about assessment and our assessment practices. Despite the many challenges these teachers faced, their innovative ideas and pioneering spirits have encouraged us to explore how classrooms can be restructured through the use of technology.

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